List of Contents

NUMBER 1

Z. P. Bažant and **A. Yavari** 1 Is the cause of size effect on structural strength fractal or energetic–statistical?

G. I. Giannopoulos, N. K. Anifantis and **D. E. Katsareas** 33 Boundary-only element analysis of crack contact under thermal shock

B. Tanguy, J. Besson, R. Piques and **A. Pineau** 49 Ductile to brittle transition of an A508 steel characterized by Charpy impact test. Part I: experimental results

D. Rittel 73 A hybrid experimental–numerical investigation of dynamic shear fracture

J. P. Petti and **R. H. Dodds Jr.** 91 Calibration of the Weibull stress scale parameter, σ_u, using the Master Curve

H. T. Xiao, Z. Q. Yue, L. G. Tham and **Y. R. Chen** 121 Stress intensity factors for penny-shaped cracks perpendicular to graded interfacial zone of bonded bi-materials

Technical Notes

T. Fett, G. Rizzi and **D. Munz** 145 *T*-stress solution for DCDC specimens

S. Alexandrov and **N. Kontchakova** 151 Influence of anisotropy on the limit load of bi-material welded cracked joints subject to tension

159 Calendar

I Keywords

NUMBER 2

Special Issue
Fracture Mechanics in Railway Applications
Guest Editors: U. Zerbst and K. Mädler

U. Zerbst and **K. Mädler** 161 Foreword

U. Zerbst, K. Mädler and **H. Hintze** 163 Fracture mechanics in railway applications—an overview

S. Beretta, A. Ghidini and **F. Lombardo** 195 Fracture mechanics and scale effects in the fatigue of railway axles

U. Zerbst, M. Vormwald, C. Andersch, K. Mädler and **M. Pfuff** 209 The development of a damage tolerance concept for railway components and its demonstration for a railway axle

M. Kuna, M. Springmann, K. Mädler, P. Hübner and **G. Pusch** 241 Fracture mechanics based design of a railway wheel made of austempered ductile iron

M. Guagliano and **L. Vergani** 255 Experimental and numerical analysis of sub-surface cracks in railway wheels

A. Skyttebol, B. L. Josefson and **J. W. Ringsberg** 271 Fatigue crack growth in a welded rail under the influence of residual stresses

G. Donzella, M. Faccoli, A. Ghidini, A. Mazzù and **R. Roberti** 287 The competitive role of wear and RCF in a rail steel

S. Mellings, J. Baynham and **R. A. Adey** 309 Automatic crack growth prediction in rails with BEM

M. Akama and **M. Saka** 319 Nondestructive sizing of a 3D surface crack generated in a railway component using closely coupled probes for direct-current potential drop technique

335 Calendar

I Keywords

NUMBER 3

A. González-Herrera and **J. Zapatero** 337 Influence of minimum element size to determine crack closure stress by the finite element method

D. Peng, C. Wallbrink and **R. Jones** 357 An assessment of stress intensity factors for surface flaws in a tubular member

A. Müller, J. Wenck, S. Goswami, J. Lindemann, J. Hohe and **W. Becker** 373 The boundary finite element method for predicting directions of cracks emerging from notches at bimaterial junctions

M. M. Attard and **F. Tin-Loi** 387 Numerical simulation of quasibrittle fracture in concrete

B. Tanguy, J. Besson, R. Piques and **A. Pineau** 413 Ductile to brittle transition of an A508 steel characterized by Charpy impact test Part II: modeling of the Charpy transition curve

S. R. Bordet, A. D. Karstensen, D. M. Knowles and **C. S. Wiesner** 435 A new statistical local criterion for cleavage fracture in steel. Part I: model presentation

S. R. Bordet, A. D. Karstensen, D. M. Knowles and **C. S. Wiesner** 453 A new statistical local criterion for cleavage fracture in steel. Part II: application to an offshore structural steel

T. Christopher, K. Sankaranarayanasamy and **B. Nageswara Rao** 475 Correlating cryogenic fracture strength using a modified two-parameter method

491 Calendar

I Keywords

NUMBER 4

M. R. Ayatollahi and **M. R. M. Aliha** 493 Cracked Brazilian disc specimen subjected to mode II deformation

Y. Bao 505 Dependence of ductile crack formation in tensile tests on stress triaxiality, stress and strain ratios

I.-T. Kim 523 Weld root crack propagation under mixed mode I and III cyclic loading

D. D. Anderson and **A. J. Rosakis** 535 Comparison of three real time techniques for the measurement of dynamic fracture initiation toughness in metals

K.-H. Schwalbe, J. C. Newman Jr. and **J. L. Shannon Jr.** 557 Fracture mechanics testing on specimens with low constraint—standardisation activities within ISO and ASTM

Y. Lei 577 J-integral evaluation for cases involving non-proportional stressing

C. A. Tang, R. H. C. Wong, K. T. Chau and **P. Lin** 597 Modeling of compression-induced splitting failure in heterogeneous brittle porous solids

A. Vaziri and **H. Nayeb-Hashemi** 617 The effect of crack surface interaction on the stress intensity factor in Mode III crack growth in round shafts

R. El-Hajjar and **R. Haj-Ali** 631 Mode-I fracture toughness testing of thick section FRP composites using the ESE(T) specimen

645 Calendar

I Keywords

NUMBER 5

T. Fett, A. B. Kounga Njiwa and **J. Rödel** 647 Crack opening displacements of Vickers indentation cracks

S. Chapuliot, M. H. Lacire, S. Marie and **M. Nédélec** 661 Thermomechanical analysis of thermal shock fracture in the brittle/ductile transition zone. Part I: description of tests

G. Z. Wang, Y. L. Wang and **J. H. Chen** 675 Effects of loading rate on the local cleavage fracture stress σ_f in notched specimens

S. Maiti and **P. H. Geubelle** 691 A cohesive model for fatigue failure of polymers

A. Valiente, J. Ruiz and **M. Elices** 709 A probabilistic model for the pearlite-induced cleavage of a plain carbon structural steel

O. Mutlu and **A. Bobet** 729 Slip initiation on frictional fractures

Z. F. Yue 749 Surface roughness evolution under constant amplitude fatigue loading using crystal plasticity

D. Hemanth, K. S. Shivakumar Aradhya, T. S. Rama Murthy and **N. Govinda Raju** 759 Strain energy release rates for an interface crack in orthotropic media—a finite element investigation

H. Okada, S. Endoh and **M. Kikuchi** 773 On fracture analysis using an element overlay technique

T. Tang, C. Y. Hui, H. G. Retsos and **E. J. Kramer** 791 Characterization of a fracture specimen for crack growth in epoxy due to thermal fatigue

807 Announcement: CISM, International Centre for Mechanical Sciences Preliminary Programme 2005

808 Announcement: ECF16

809 Calendar

I Keywords

NUMBER 6

Special Issue
Prospects in Fracture Papers from a Conference held to Celebrate the 65th Birthday of Professor J.G. Williams, FRS, FREng. Imperial College London, July 2003
Guest Editors: B.R.K. Blackman and A.J. Kinloch

Editorial
B. R. K. Blackman and **A. J. Kinloch** 811 Special edition devoted to papers from a Conference on 'Prospects in Fracture' 8th to 9th July 2003 to celebrate the 65th birthday of Professor J.G. Williams, FRS, FREng

J. G. Williams 813 A global energy analysis of impact loaded bi-material strips

B. Cotterell, T. Pardoen and **A. G. Atkins** 827 Measuring toughness and the cohesive stress–displacement relationship by the essential work of fracture concept

A. G. Atkins 849 Toughness and cutting: a new way of simultaneously determining ductile fracture toughness and strength

N. Murphy and **A. Ivankovic** 861 The prediction of dynamic fracture evolution in PMMA using a cohesive zone model

B. R. K. Blackman, A. J. Kinloch and **M. Paraschi** 877 The determination of the mode II adhesive fracture resistance, G_{IIC}, of structural adhesive joints: an effective crack length approach

A. J. Brunner and **P. Flüeler** 899 Prospects in fracture mechanics of "engineering" laminates

L. N. McCartney 909 Energy-based prediction of failure in general symmetric laminates

S. M. Goh, M. N. Charalambides and **J. G. Williams** 931 On the mechanics of wire cutting of cheese

P. S. Leevers and **L. Moreno** 947 Surface layer stiffness effects on fracture of polymer multilayers: a linear elastic model

J. A. Nairn 961 Simulation of crack growth in ductile materials

981 Calendar

I Keywords

NUMBER 7

C. K. Lee, L. S. Tjhen, C. S. Ping and **S. Yongbo** — 983 — Numerical models verification of cracked tubular T, Y and K-joints under combined loads

A. B. Kounga Njiwa, S. Galal Yousef, T. Fett and **J. Rödel** — 1011 — Influence of microcracking on crack-tip toughness of alumina

D. Taylor, P. Cornetti and **N. Pugno** — 1021 — The fracture mechanics of finite crack extension

K. M. Prabhakaran and **V. Venkat Raj** — 1039 — Elastic *J-integral* solution for an elbow with axial through-wall crack at crown under in-plane bending

Y. Bao and **T. Wierzbicki** — 1049 — On the cut-off value of negative triaxiality for fracture

T. Børvik, O. S. Hopperstad, S. Dey, E. V. Pizzinato, M. Langseth and **C. Albertini** — 1071 — Strength and ductility of Weldox 460 E steel at high strain rates, elevated temperatures and various stress triaxialities

K. Enami — 1089 — The effects of compressive and tensile prestrain on ductile fracture initiation in steels

Discussion

I. V. Rokach — 1107 — Discussion on the paper "Evaluation of dynamic fracture toughness K_{Id} by Hopkinson pressure bar loaded instrumented Charpy impact test" by Jiang Fengchun, Liu Ruitang, Zhang Xiaoxin, Kenneth S. Vecchio and Aashish Rohatgi, Engineering Fracture Mechanics, 71 (2004) pp. 279–287

Technical Note

J. C. Newman Jr. and **M. Jordan Haines** — 1113 — Verification of stress-intensity factors for various middle-crack tension test specimens

1119 — Calendar

I — Keywords

NUMBER 8

J. D. Landes and **S. Hopkins** — 1123 — Personal Report: Edward T. Wessel (1923–2004)

M. A. Pérez, J. M. García and **M. Doblaré** — 1125 — Analysis of the debonding of the stem–cement interface in intramedullary fixation using a non-linear fracture mechanics approach

A. Ural, G. Heber, P. A. Wawrzynek, A. R. Ingraffea, D. G. Lewicki and **J. B. C. Neto** 1148 Three-dimensional, parallel, finite element simulation of fatigue crack growth in a spiral bevel pinion gear

C. G. Hwang, P. A. Wawrzynek and **A. R. Ingraffea** 1171 On the calculation of derivatives of stress intensity factors for multiple cracks

F. Wang, H. P. Lee and **C. Lu** 1197 Relations between structural intensity and *J*-integral

H. Lee, N. Kim and **T. S. Lee** 1203 Overload failure curve and fatigue behavior of spot-welded specimens

S. Beretta and **M. Carboni** 1222 A Strip-Yield algorithm for the analysis of closure evaluation near the crack tip

T. J. Massart, R. H. J. Peerlings, M. G. D. Geers and **S. Gottcheiner** 1238 Mesoscopic modeling of failure in brick masonry accounting for three-dimensional effects

A. Carpinteri and **N. Pugno** 1254 Fracture instability and limit strength condition in structures with re-entrant corners

F. J. Gómez, M. Elices and **J. Planas** 1268 The cohesive crack concept: application to PMMA at −60°C

S. S. Chakravarthy, E. H. Jordan and **W. K. S. Chiu** 1286 Thin film and substrate cracking under the influence of externally applied loads

I Calendar

IV Keywords

NUMBER 9

A. Th. Diamantoudis and **G. N. Labeas** 1299 Stress intensity factors of semi-elliptical surface cracks in pressure vessels by global-local finite element methodology

A. Carpinteri, A. Spagnoli and **S. Vantadori** 1313 Mechanical damage of ordinary or prestressed reinforced concrete beams under cyclic bending

D. Peng, C. Wallbrink and **R. Jones** 1329 Stress intensity factor solutions for finite body with quarter-elliptical flaws emanating from a notch

S. Cravero and **C. Ruggieri** 1344 Correlation of fracture behavior in high pressure pipelines with axial flaws using constraint designed test specimens—Part I: Plane-strain analyses

J.-H. Zhao 1361 Application of virtual crack closure integral method for interface cracks in low-*k* integrated circuit devices under thermal load

F. Zhou, J.-F. Molinari and **T. Shioya** 1383 A rate-dependent cohesive model for simulating dynamic crack propagation in brittle materials

A. Bobet and **O. Mutlu** 1411 Stress and displacement discontinuity element method for undrained analysis

S. R. Daniewicz and **G. P. Potirniche** 1438 Modeling of fatigue crack growth threshold development for a microstructurally small crack

Technical Note

S. Xu, G. Shen and **W. R. Tyson** 1454 Effect of crack-tip plasticity on crack length estimation methods for SENB sample

I Calendar

III Keywords

NUMBER 10

J. Chattopadhyay, T. V. Pavankumar, B. K. Dutta and **H. S. Kushwaha** 1461 Fracture experiments on through wall cracked elbows under in-plane bending moment: Test results and theoretical/numerical analyses

C. Song 1498 Evaluation of power-logarithmic singularities, *T*-stresses and higher order terms of in-plane singular stress fields at cracks and multi-material corners

S. N. Wosu, D. Hui and **P. K. Dutta** 1531 Dynamic mixed-mode I/II delamination fracture and energy release rate of unidirectional graphite/epoxy composites

J. A. Joyce and **R. L. Tregoning** 1559 Determination of constraint limits for cleavage initiated toughness data

T. Nykänen, X. Li, T. Björk and **G. Marquis** 1580 A parametric fracture mechanics study of welded joints with toe cracks and lack of penetration

S. Naboulsi 1610 Applications of crack analogy to fretting fatigue

H. Qiu, M. Enoki, K. Hiraoka and **T. Kishi** 1624 Effect of pre-strain on fracture toughness of ductile structural steels under static and dynamic loading

I Announcement: ECF16

II Calendar

IV Keywords

NUMBER 11

M. C. Walters, G. H. Paulino and **R. H. Dodds Jr.** 1635 Interaction integral procedures for 3-D curved cracks including surface tractions

A. Cadario and **B. Alfredsson** 1664 Fretting fatigue crack growth for a spherical indenter with constant and cyclic bulk load

N. Merah, F. Saghir, Z. Khan and **A. Bazoune** 1691 A study of frequency and temperature effects on fatigue crack growth resistance of CPVC

M. Salahuddin Habibullah and **A. R. S. Ponter** 1702 Ratchetting limits for cracked bodies subjected to cyclic loads and temperatures

H. Okada, M. Higashi, M. Kikuchi, Y. Fukui and **N. Kumazawa** 1717 Three dimensional virtual crack closure-integral method (VCCM) with skewed and non-symmetric mesh arrangement at the crack front

D. Stevanovic, S. Kalyanasundaram, A. Lowe and **P.-Y. B. Jar** 1738 FEA of crack–particle interactions during delamination in interlayer toughened polymer composites

Technical Note

P. Isaksson and **P. A. Gradin** 1770 A bending specimen for constant energy release rate under controlled displacement conditions

I Calendar

III Keywords

NUMBER 12

Special Issue
International Conference on Heterogeneous Material Mechanics, Chongqing University and Yangtze River/Three Gorges, China, 21–26 June, 2004
Guest Editors: M. Zhou and J. Qu

Editorial **M. Zhou** and **J. Qu**	1777	Special Issue for the International Conference on Heterogeneous Material Mechanics, Chongqing University and Yangtze River/Three Gorges, China, 21–26 June, 2004
P. Tong, D. C. C. Lam and **F. Yang**	1779	Mode I solution for micron-sized crack
Z.-H. Jin and **C. T. Sun**	1805	Cohesive zone modeling of interface fracture in elastic bi-materials
W. Zhang and **X. Deng**	1818	Formulation of a cohesive zone model for a Mode III crack
S. H. Lo, C. Y. Dong and **Y. K. Cheung**	1830	Integral equation approach for 3D multiple-crack problems
L. Ma, X. Wang, X.-Q. Feng and **S.-W. Yu**	1841	Numerical analysis of interaction and coalescence of numerous microcracks
J. M. Hendrickx, P. H. Geubelle and **N. R. Sottos**	1866	A spectral scheme for the simulation of dynamic mode 3 delamination of thin films
H. Hirakata, T. Kitamura and **T. Kusano**	1892	Pre-cracking technique for fracture mechanics experiments along interface between thin film and substrate
D. Rittel and **A. J. Rosakis**	1905	Dynamic fracture of berylium-bearing bulk metallic glass systems: A cross-technique comparison
V. Tomar and **M. Zhou**	1920	Deterministic and stochastic analyses of fracture processes in a brittle microstructure system
Y.-S. Wang, G.-Y. Huang and **D. Gross**	1942	The fracture analysis of a graded coating/substrate system of finite thickness with arbitrary spatial variations of coating properties: Plane deformation

R. C. Batra and **B. M. Love** 1954 Crack propagation due to brittle and ductile failures in microporous thermoelastoviscoplastic functionally graded materials

Y. Zhou, C. Li and **J. J. Mason** 1980 Fiber-end deformation effects in enlarged-end, fiber-reinforced composites

S. Nickerson, J. S. Mayes and **J. S. Welsh** 1993 Multi-continuum analysis of thermally induced matrix cracking

J.-R. Li and **J.-L. Yu** 2009 Computational simulations of intergranular fracture of polycrystalline materials and size effect

I Calendar

III Keywords

NUMBER 13

S. R. Chidgzey and **A. J. Deeks** 2019 Determination of coefficients of crack tip asymptotic fields using the scaled boundary finite element method

Q. Lu and **B. Bhattacharya** 2037 The role of atomistic simulations in probing the small-scale aspects of fracture—a case study on a single-walled carbon nanotube

C. R. Chen, O. Kolednik, J. Heerens and **F. D. Fischer** 2072 Three-dimensional modeling of ductile crack growth: Cohesive zone parameters and crack tip triaxiality

M. Heyder, K. Kolk and **G. Kuhn** 2095 Numerical and experimental investigations of the influence of corner singularities on 3D fatigue crack propagation

M. Okayasu, Z. Wang and **D. L. Chen** 2106 Effect of a hard artificial asperity on the crack closure behavior in an annealed SAE 1015 steel

Y.-B. Wang and **Y.-Z. Sun** 2128 A new boundary integral equation method for cracked 2-D anisotropic bodies

S. R. Choi, D. Zhu and **R. A. Miller** 2144 Fracture behavior under mixed-mode loading of ceramic plasma-sprayed thermal barrier coatings at ambient and elevated temperatures

I Calendar

III Keywords

NUMBER 14

F. Suat Kadioğlu 2159 Edge cracks in a transversely isotropic hollow cylinder

S. Courtin, C. Gardin, G. Bézine and **H. Ben Hadj Hamouda** 2174 Advantages of the *J*-integral approach for calculating stress intensity factors when using the commercial finite element software ABAQUS

J. Chattopadhyay, A. K. S. Tomar, B. K. Dutta and **H. S. Kushwaha** 2186 Elastic–plastic *J* and COD estimation schemes for throughwall circumferentially cracked elbow under in-plane closing moment

F. Baldi and **T. Riccò** 2218 High-rate *J*-testing of toughened polyamide 6/6: Applicability of the load separation criterion and the normalization method

P. F. P. de Matos, P. M. G. P. Moreira, I. Nedbal and **P. M. S. T. de Castro** 2232 Reconstitution of fatigue crack growth in Al-alloy 2024-T3 open-hole specimens using microfractographic techniques

C.-H. Sam, K. D. Papoulia and **S. A. Vavasis** 2247 Obtaining initially rigid cohesive finite element models that are temporally convergent

E. M. Castrodeza, F. L. Bastian and **J. E. Perez Ipiña** 2268 Fracture toughness of unidirectional fiber–metal laminates: crack orientation effect

Z. J. Yang and **J. Chen** 2280 Finite element modelling of multiple cohesive discrete crack propagation in reinforced concrete beams

I Calendar

III Keywords

NUMBER 15

P. Isaksson and **R. Hägglund** 2299 A mechanical model of damage and delamination in corrugated board during folding

D. Zheng, Q. Li and **L. Wang** 2316 A microscopic approach to rate effect on compressive strength of concrete

L. Banks-Sills, I. Hershkovitz, P. A. Wawrzynek, R. Eliasi and **A. R. Ingraffea** 2328 Methods for calculating stress intensity factors in anisotropic materials: Part I—$z = 0$ is a symmetric plane

K. Tohgo, T. Suzuki and **H. Araki** 2359 Evaluation of *R*-curve behavior of ceramic–metal functionally graded materials by stable crack growth

A. H. Sherry, M. A. Wilkes, D. W. Beardsmore and **D. P. G. Lidbury** 2373 Material constraint parameters for the assessment of shallow defects in structural components–Part I: Parameter solutions

A. H. Sherry, D. G. Hooton, D. W. Beardsmore and **D. P. G. Lidbury** 2396 Material constraint parameters for the assessment of shallow defects in structural components. Part II: Constraint-based assessment of shallow defects

Technical Note

X. Gao and **R. H. Dodds Jr.** 2416 Loading rate effects on parameters of the Weibull stress model for ferritic steels

I Calendar

III Keywords

NUMBER 16

F. Barpi and **S. Valente** 2427 Lifetime evaluation of concrete structures under sustained post-peak loading

M. T. Tilbrook, R. J. Moon and **M. Hoffman** 2444 Finite element simulations of crack propagation in functionally graded materials under flexural loading

A. P. Bunger and **E. Detournay** 2468 Asymptotic solution for a penny-shaped near-surface hydraulic fracture

D. Xie, A. M. Waas, K. W. Shahwan, J. A. Schroeder and **R. G. Boeman** 2487 Fracture criterion for kinking cracks in a tri-material adhesively bonded joint under mixed mode loading

Z. Zhang and **F. Ansari** 2505 Crack tip opening displacement in micro-cracked concrete by an embedded optical fiber sensor

G. R. Murtagian, D. H. Johnson and **H. A. Ernst** 2519 Dynamic crack propagation in steel line pipes. Part I: Experimental investigation

G. R. Murtagian and **H. A. Ernst** 2535 Dynamic axial crack propagation in steel line pipes. Part II: Theoretical developments

H. Sekine, B. Yan and **T. Yasuho** 2549 Numerical simulation study of fatigue crack growth behavior of cracked aluminum panels repaired with a FRP composite patch using combined BEM/FEM

I Calendar

III Keywords

NUMBER 17

R. Walter, L. Østergaard, J. F. Olesen and **H. Stang** 2565 Wedge splitting test for a steel–concrete interface

Z. Huang, Z. Suo, G. Xu, J. He, J. H. Prévost and **N. Sukumar** 2584 Initiation and arrest of an interfacial crack in a four-point bend test

F.-Z. Xuan, S.-T. Tu and **Z. Wang** 2602 A modification of ASTM E 1457 C^* estimation equation for compact tension specimen with a mismatched cross-weld

A. B. de Morais and **M. F. S. F. de Moura** 2615 Assessment of initiation criteria used in interlaminar fracture tests of composites

X. Chen, Y. C. Lin, X. Liu and **G.-Q. Lu** 2628 Fracture mechanics analysis of the effect of substrate flexibility on solder joint reliability

M. A. Meggiolaro, A. C. O. Miranda, J. T. P. Castro and **L. F. Martha** 2647 Stress intensity factor equations for branched crack growth

S. Izumi, C. W. Ping, M. Yamaguchi, S. Sakai, Y. Ueda and **A. Suzuki** 2672 Development of specimen and test method for strength analysis of MEMS micromirror

A. Szekrényes and **J. Uj** 2686 Advanced beam model for fiber-bridging in unidirectional composite double-cantilever beam specimens

I Calendar

III Keywords

NUMBER 18

P. Ljustell and **F. Nilsson** 2703 Variable amplitude crack growth in notched specimens

R. Kitey and **H. V. Tippur** 2721 Dynamic crack growth in particulate bimaterials having discrete and diffuse interfaces: Role of microstructure

M. P. Wnuk and **A. Yavari** 2744 A correspondence principle for fractal and classical cracks

A. Dorogoy and **L. Banks-Sills** 2758 Effect of crack face contact and friction on Brazilian disk specimens—A finite difference solution

T. Fett, J.-P. Guin and **S. M. Wiederhorn** 2774 Interpretation of effects at the static fatigue limit of soda-lime-silicate glass

B. N. Legarth 2792 Effects of geometrical anisotropy on failure in a plastically anisotropic metal

R. Brighenti 2808 Application of the element-free Galerkin meshless method to 3-D fracture mechanics problems

F. Dubois and **C. Petit** 2821 Modelling of the crack growth initiation in viscoelastic media by the $G\theta_v$-integral

I Calendar

V Contents list

XX Author index

XXIII Keywords